Total Ionizing Dose Test of OP200 Operational Amplifier (Analog Devices).

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1. Introduction

A radiation evaluation was performed on OP200 operational amplifier to determine its tolerance to total dose ionizing radiation.

2. Part and Test Information

Table I contains information on the parts and the test. Fig. 1 shows the pin-out for the part.

Table I.
Part and Test Information

Generic Part Number:	OP200
Full Part Number:	5962-8859301M2A
Manufacturer:	Analog Devices
Lot Date Code (LDC):	0245A
Quantity Tested:	3
Serial Numbers of Control Sample:	0
Serial Numbers of Radiation Samples:	1, 2, 3
Part Function:	Operational Amplifier
Part Technology:	Bipolar
Package Style:	LCC
Test Equipment:	Parametric analyzer, power supply
Test Engineer:	J. Forney
Case markings:	2A 5962-8859301M2A Q 0245A

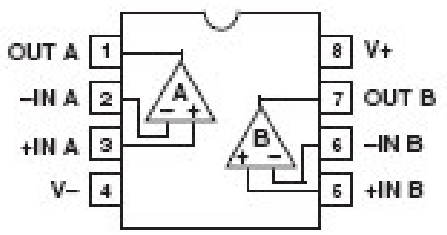

Fig. 1. Pin-out for the OP200

3. Test Method

Total dose testing was performed by exposing the devices to gamma rays using the NASA/GSFC Co^{60} gamma ray source. Three parts were irradiated under bias (see Figure 1 for bias configuration). There were no control samples. The target dose rate was approximately 0.02 rads/s. Fig. 2 shows the bias circuit used during exposure and during testing. The supply was +/- 15 V. The part was configured as a voltage follower and during irradiation I(in)+ was grounded and the output was left floating. A parametric analyzer was used to do the measurements.

Initial electrical measurements were made on 3 samples. After each radiation exposure, parts were electrically tested.

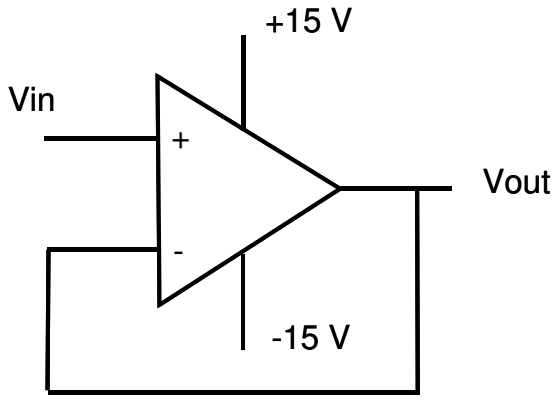

Fig. 2. Radiation Bias and Test Circuit for OP200. V_{in} was grounded and V_{out} was left floating.

4. Results

The tables below show the results of the electrical parametric measurements.

Table II
Supply Current (A) as a Function of Total Dose
(Max. = 1.4 mA)

TID	DUT#1	DUT#2	DUT#3	Average	St. Dev.
0	1.18E-03	1.21E-03	1.20E-03	1.20E-03	1.47E-05
5	1.16E-03	1.18E-03	1.17E-03	1.17E-03	1.25E-05
10	1.14E-03	1.16E-03	1.15E-03	1.15E-03	1.07E-05
15	8.20E-04	7.63E-04	7.92E-04	7.91E-04	2.86E-05
20	1.10E-03	1.12E-03	1.11E-03	1.11E-03	8.94E-06
30	1.07E-03	1.09E-03	1.08E-03	1.08E-03	8.88E-06
40	1.05E-03	1.07E-03	1.06E-03	1.06E-03	9.24E-06
50	1.04E-03	1.06E-03	1.05E-03	1.05E-03	9.76E-06
75	1.02E-03	1.05E-03	1.03E-03	1.04E-03	1.14E-05

Table III
Input Bias Current (A) as a Function of Total Dose
(Max. = 2 nA)

TID	DUT#1	DUT#2	DUT#3	Average	St. Dev.
0	5.77E-11	6.15E-11	1.94E-11	4.62E-11	1.90E-11
5	3.94E-10	3.04E-10	3.90E-10	3.62E-10	4.16E-11
10	1.27E-10	3.51E-11	1.92E-10	1.18E-10	6.42E-11
15	2.70E-10	5.78E-10	4.51E-10	4.33E-10	1.26E-10
20	9.99E-10	1.77E-09	1.64E-09	1.47E-09	3.37E-10
30	3.52E-09	5.34E-09	5.36E-09	4.74E-09	8.61E-10
40	7.07E-09	9.60E-09	9.76E-09	8.81E-09	1.23E-09
50	1.05E-08	1.31E-08	1.43E-08	1.26E-08	1.56E-09
75	2.29E-08	2.78E-08	2.71E-08	2.59E-08	2.18E-09

Table IV
Input Offset Voltage (V) as a Function of Total Dose
(Max. = 75 µV)

TID	DUT#1	DUT#2	DUT#3	Average	St. Dev.
0	-2.00E-05	-6.00E-05	-6.00E-05	-4.67E-05	2.31E-05
5	-8.00E-05	-5.00E-05	-5.00E-05	-6.00E-05	1.73E-05
15	1.00E-06	-4.00E-05	-6.00E-05	-3.30E-05	3.11E-05
20	2.00E-06	-3.00E-05	-7.00E-05	-3.27E-05	3.61E-05
30	1.50E-05	-3.00E-05	-7.00E-05	-2.83E-05	4.25E-05
40	2.50E-05	5.00E-06	-5.00E-05	-6.67E-06	3.88E-05
50	2.00E-05	2.00E-05	-6.00E-05	-6.67E-06	4.62E-05
75	5.00E-05	0.00E+00	-8.00E-05	-1.00E-05	6.56E-05

5. Conclusion

The input bias current went out of specification for all three parts between 20 and 30 krad(Si).